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REPRINT
AVIATION SAFETY FROM COVER TO COVER

INTO THE NIGHT

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The accident which occurred on July 16, 1999, and which took the lives of John F. Kennedy, Jr., Carolyn Bessette Kennedy, and Lauren Bessette is one of those unfortunate reminders that we might need to take a look at our night VFR proficiency. This is the reprint of a two-part series on VFR night operations wich appeared in the October and November/December 1999 issues. We'll discuss preflight planning and preparation for a VFR night flight (taking into consideration some areas that are not usually heeded), night operations, and spatial disorientation. None of the information in either article should be construed as having any bearing on the as yet to be determined probable cause of the Kennedy accident. —Editor

In my salad days—which are longer ago than I care to admit—when I was accumulating hours, I accepted a "commission" from a friend to fly along to ferry an aircraft from the east coast to the middle of the country. My friend knew I wanted to build time since I was, at the time of the offer, a private pilot with not quite 100 hours. I was to do the planning for the nearly 2,500+ mile roundtrip flight, the flying, the navigating, etc., and he would sit there and relax, occasionally critique. The expenses were being paid by the aircraft's owner, so who would turn down that opportunity?

The next goal in my aviation career was an instrument rating, and in the early 1980's you had to have 200 hours total time before you could even apply for an instrument rating. In my mind, I had a dismally long way to go, so the prospect of some real cross-country experience in a complex aircraft and the addition of a good chunk of "free" time to my logbook was too much to pass up. (In 1986, FAA changed the requirement to 125 hours total time and a private pilot certificate, and in 1997 the requirements changed again to only having a private pilot certificate.)

It turned out that getting my complex airplane endorsement was the least complicated event during this trip. Literally, everything that could go wrong did go wrong, from a blown magneto to being weathered in. The best lesson for me was that I realized I was in an airplane I wasn't really familiar with, in weather conditions I wasn't ready for, on a trip that was more than following a line marked on a chart. I had the benefit of an experienced pilot with me so that those lessons weren't learned the hard way.

The one leg that stands out in my mind is a night-time takeoff from somewhere in Mississippi and crossing Louisiana in the dead of a nearly moonless, hazy, summer night. The countryside we flew over was sparsely populated—no city lights—and this was after midnight. It was like being immersed in an inkwell. It was black out the windows, black when I looked down. If I twisted and looked up through the windscreen I could see stars, but ground and sky met and fused so completely that the natural horizon was obscured, hidden, nonexistent, or, in the parlance of my youth, "it warn't there." The weather reports and forecasts dutifully checked before flight indicated VMC from Mississippi across to Texas.

That was my lesson in how insidious the onset of spatial disorientation can be, not to mention that the weather is never what you want it to be. Obviously, this night flight was successful because, well, I'm here nearly 20 years later to talk about it. Would I be if I hadn't had that experienced pilot along? Speculation, of course, but it's something I've wondered about every time I've read or written about or heard of an accident attributable to spatial disorientation or during a night VFR flight.

Is night VFR flight inherently dangerous? The answer is a qualified "No." To explain this, read the following quote from an article we published seven years ago called "Doing it in the Dark" and written by FAA Aviation Safety Inspector and Safety Program Manager Bruce Edsten:

> *"Probably the most important item to be considered in planning a night flight is YOU, the pilot.* Flying at night requires a bit more attention to the task at hand than flying in the daytime, so you want to be sure you are up to it." [Emphasis added.]

A night VFR flight can be completed safely with good and careful preflight planning and preparation and with an attitude en route that you will either 180 to a safe harbor if something deteriorates or call for assistance. Some people like flying at night—less traffic at the airport, smoother air, less workload on controllers so you have greater access for practicing night landings or instrument approaches. There are many advantages. And there are always disadvantages: a lack of visual cues for navigation, inability to "see" weather, not to mention the possibility (unlikely as it is) of the spine-tingling engine-out or other aircraft emer-

gency at night.

To assure a safe night VFR flight, take advantage of those advantages and address the disadvantages before you leave the ground. To do that there are essentially four areas you need to consider and plan for: the pilot, the aircraft, the environment, and the pressure of external influences. Failing to consider or to prepare fully for any one of these can be a recipe for grief. Accidents, day or night, are seldom a single, catastrophic occurrence—despite the media portrayals. They are the result of a chain of events that accumulate to the point where pilot and aircraft can be overwhelmed. Break any link in that chain, and you don't hang yourself.

Statistics and Accident Data

For the five years between January 1, 1994, and December 31, 1998, there were 886 total general aviation accidents at night. That is approximately 170 per year or about one-fifth of the total general aviation accidents. Of those nearly 900 accidents, we selected 10 at random which specifically cited "night VFR" in the accident's narrative or as a cause or factor. Of those 10 random accidents, eight were fatal, with 12 fatalities. Even if this random sample can be extrapolated to all night accidents, you can see that just like continued VFR flight into IMC, night accidents appear to have a high fatality rate.

The probable causes for these accidents read like a primer on what not to do and nearly everything that can go wrong on a night VFR flight:

- "The pilot's inadequate clearance above an unlighted ridgeline in clouds and fog at night, and his decision to not file an IFR flight plan and his VFR flight into IMC conditions."
- "The pilot's failure to maintain clearance from terrain. Factors include the pilot inadvertently becoming lost/disoriented, the dark night (minimum ambient light), and mountainous/hilly terrain."
- "Continued VFR flight by the pilot into instrument meteorological conditions, and his failure to maintain altitude and/or clearance from high terrain. Factors relating to the accident were: darkness, low ceiling, fog, and high (mountainous) terrain along the route."
- "Failure of the pilot to maintain sufficient altitude and/or clearance from terrain while on a cross-country flight at night. Factors relating to the accident were: darkness, the prevailing low ceilings, and mountainous/hilly terrain."
- "The pilot's decision to attempt a takeoff with the runway lights inoperative, and his failure to maintain runway alignment during an aborted takeoff, after failure of the landing light. Factors relating to the accident were: darkness, inoperative runway lights, failure of the landing light, and the encounter with soft terrain."
- "The pilot's inadequate preflight planning/preparation by not obtaining a preflight weather briefing, his VFR flight into instrument meteorological conditions, and his failure to maintain control of the aircraft after becoming spatial disoriented [sic]. Factors relating to the accident were: darkness and the pilot's lack of recent experience in the type of operation (night and actual instrument meteorological conditions)."
- "The pilot becoming lost and disoriented during a night VFR flight in marginal weather conditions. Factors in the accident were: the pilot's lack of night flying experience, his failure to obtain a preflight weather briefing, low ceilings, and his failure to reverse course to known clear weather conditions when he first encountered the low ceilings."
- "The pilot's failure to maintain proper altitude in the visual flight rules (VFR) traffic pattern. Contributing to the accident were the pilot's failure to follow dispatch procedures, the dark night conditions, and the unavailability of the airport's pilot-controlled runway and precision approach path indicator lights."
- "Failure of the chase helicopter to maintain clearance from the lead helicopter during a night approach to land. Possible factors relating to the accident were: darkness and inadequate radio coordination between flight crews of the two helicopters."
- "Fuel exhuastion [sic] as a result of the pilots [sic] improper fuel calculation and improper use of fuel mixture."

Of the pilots involved in these 10 accidents, seven were private pilots, two were commercial pilots, and three were ATP's. (The numbers don't add up to 10 because some pilots had dual privileges, i.e., commercial privileges for some category and class of aircraft, ATP or private for another.) Total pilot time ranged from a low of 75 hours (private pilot) to nearly 18,000 hours (commercial, CFI). Coincidentally, neither accident involving the low-time pilot or the high-time pilot was fatal, but of the eight fatal accidents, five involved private pilots, only two of whom had instrument ratings. Of those two, one instrument rated pilot's lack of IFR proficiency was cited as a factor in the fatal accident.

Again, these 10, random accidents are but a snapshot of night VFR, but they do serve to show that the margin of error at night is very slim if you are unprepared.

Regulatory Requirements for Night Flight

To conduct a flight VFR at night, you must have specific fuel reserves that exceed what is required for day VFR. Namely, you must have sufficient fuel to fly to the point of intended arrival and to fly for another 45 minutes after that at normal cruising speed. (FAR § 91.151)

If you're already a certificated pilot, to be pilot in command of an aircraft carrying passengers at night (one hour after sunset to one hour before sunrise), you must have had three takeoffs and landings to a full stop at night within the preceding 90 days. You have to have been the sole manipulator of the controls during those three

takeoffs and landings, and they have to have been accomplished in an aircraft of the same category and class and type, if a type rating is required, as the flight you're about to take. The three takeoffs and landings to qualify for night recency of experience can be accomplished in a flight simulator that is approved for takeoffs and landings and used in accordance with a course conducted by a FAR part 142 training center. (FAR § 61.57)

Night training requirements for private pilot certification were increased when FAR parts 61 and 141 were changed in 1997. Now, in order to receive a private pilot's certificate, during your primary training you must have received at least three hours in night flight training, including one cross-country flight of over 100 nautical miles and 10 takeoffs and landings to a full stop at an airport. Each landing must have involved a flight in the traffic pattern at an airport. "To a full stop" means no touch-and-go's.

This begs the differentiation once more between currency and proficiency. The more often you do something, the better you become at it. That's proficiency. As a pilot you can opt to meet the minimum standards in the regulations, and you will be considered current as far as the requirements go. But are you proficient if all you do every 90 days is three takeoffs and three landings at night? Are you proficient if your last night cross-country was the one you took to qualify for your private pilot certificate? Are you proficient if your only night experience in the past two years consists of questions asked by an instructor during a flight review?

We've all heard the old adage that a boat is a hole in the water you pour money into, and a new aircraft owner here in the editorial offices has extended that to the air: His *Tripacer* is a hole in the air that he pours money into. To me, that's part of the fun, but why not put some of that money to another use? The new bells and whistles are fine, but an hour of dual once a month or so that includes some night flying, a night cross-country, or some hood time might be a better long-term investment. If you have to choose between buying currency (recency of experience, that is) or buying proficiency, proficiency is a sure profit.

International Comparison

How do the U.S. requirements measure up against international ones? That is a somewhat difficult comparison on a country by country basis. Ninety percent of the world's general aviation pilot population has access to VFR at night. (Half of the world's pilot population is in North America.) But the conditions under which night VFR can be conducted do vary.

Annex 1 of the International Civil Aviation Organization (ICAO) requires extra training for night flight (minimum three hours, maximum 10) that involves takeoffs and landings and navigation training. The requirements are similar to the U.S. There is no ICAO requirement for a night rating or an endorsement. Some signatories to ICAO do not permit VFR at night in controlled airspace. Some require an instrument rating before a pilot can fly VFR at night.

Our neighbor to the north, Canada, requires the filing of a flight plan for VFR at night, but Canada has a great deal more sparsely settled territory than the U.S. Canadian regulations also require a night "rating," which consists of 10 hours of flight instruction at night—five hours dual, five hours solo. Two hours of the dual must be cross-country, and during the five solo hours there must be 10 takeoffs and landings. The pilot must also have 10 hours of instrument training. Canada also raises its VFR weather minima for night flight.

In France, for another example, to fly at night a pilot must have had night training and an endorsement from a flight instructor and three to five night landings in the past six months. There are two types of night flight: local airport flights and night VFR cross-country. For the latter, a flight plan is required, and the flight must be conducted in a positive control environment. Pilots are also required to follow a designated route (VFR and IFR traffic have separate routes) that has specific reporting points.

Other European countries have similar or more restrictive requirements. Italy and Switzerland are said to have the most restrictive requirements for general aviation, period, not just at night. The significant reason for Europe's more restrictive stance stands out when you study a topographical map. Most of Europe's geographic area is mountainous, unlike the U.S. which has a huge tract of flat space between its two major mountain ranges.

The Pilot

If you turn back to the quote we cited fairly early in this article, you'll note that THE most important aspect of a night VFR flight is the pilot. As my primary flight instructor used to say, "The airplane is metal and plastic and has no brain. You do." The very first aspect of planning your VFR night flight is to sit down and realistically assess YOU—your total experience and recency of experience as well as your physical condition. Ask yourself the following questions, bearing in mind the fact that you'll be flying at night, VFR.

Experience/Recency

How many night takeoffs and landings have you had in the last how many days?

How many hours do you have in the make and model aircraft you're about to fly? How recent is that time?

If you're instrument rated, how many instrument approaches have you made recently? Were they simulated or actual? When was the last time you made an approach? Was it to minimums?

How many instrument flight hours do you have? How recent is the time? Was it simulated or actual?

How familiar are you with the terrain you'll be flying over at night? How familiar are you with the types of airspace along your route or at your arrival?

Why all the questions about instrument time if this is a VFR at night flight? One of your key skills in assuring a safe night VFR flight is the ability

to transition smoothly from flying using visual cues outside the cockpit to flying solely by reference to instruments. Night flying can mean an obscured or apparently nonexistent natural horizon as well as the risk of flying into "unseeable" clouds, and an artificial horizon and other associated instruments in the cockpit are useless to you unless you have proficiency in interpreting them. An instrument rating may not be required to fly at night VFR in the U.S., but proficiency in flying solely by reference to instruments is tremendous insurance. And it comes cheap—a few hours flown regularly with a flight instructor, and you have a skill that can literally save your life.

Physical Condition

The possession of your medical certificate means that you met the standards for medical certification on the date that the certificate was issued. Whether you are physically capable of safely operating the aircraft is a day-to-day, perhaps hour-to-hour self-assessment. Even after you've determined that your experience and your currency are appropriate for a VFR night flight, ask yourself the following questions.

How much sleep have you had in the past 24 hours? Was it restful, uninterrupted?

How much food and water have you had recently? Will you be able to make the flight without hypoglycemia or dehydration?

When was your last alcoholic beverage? The rules say eight hours from "bottle to throttle," but some people metabolize alcohol differently and may require more time for their blood alcohol level to be within the requirements.

Are you taking any drugs or medications, prescribed or over-the-counter? When was the last time you took them? Did your aviation medical examiner approve their use?

When was your last illness? By illness we mean colds, flu, upset stomach, etc., as well as long-term conditions.

What about the stressful events in your life? Did an employee upset you at work? Did an important project fall through? Was the car ready from the repair shop when it was supposed to be? Did you have a row with your spouse or a child? Were you late to the airport? Was there traffic gridlock on the way? Was a passenger late? The questions in this area are infinite because at any time, any event can be a stressor, and stress can diminish your physical performance.

The important thing to remember here is that you want all of these areas—experience and currency and physical condition—to be optimum. You might feel great, be stress-free, but you haven't flown at night in a couple of months. You might not only be current but also proficient at night flight, but you had a bad day at work or at home. Obviously, in your planning you want to set standards for yourself that may actually exceed what the FAA requires. You may not be 100% in both the above areas, but if you meet the limits you've established for yourself then don't exceed them, the pilot is probably ready to go.

The Aircraft

We'll concede that your aircraft is airworthy and equipped for a VFR night flight. (If you're not certain of what equipment is required for a night flight, check FAR § 91.205.) Let's take a look at, again, possibly extending those standards a bit.

Fuel Reserves

Earlier, we paraphrased the fuel requirements for VFR at night. The first thing you need to consider is planning your fuel stops if you don't carry sufficient fuel to make the destination in one leg. Every person you add to the cabin and every piece of luggage to the baggage area reduces the amount of fuel you can carry. You might want to increase your fuel reserves beyond what is required for VFR at night, unless, of course, you get a kick out of

those night time, engine-out landings in the middle of Nowheresville.

The night VFR fuel requirements and reserves in the FAR are minimum requirements, remember. If you exceed them, then you have increased your safety margin. For example, if this is your personal aircraft you're flying, you're very familiar with its fuel burn, and your night navigation skills are top notch, maybe a 45-minute reserve is sufficient.

But what if you were to plan the night VFR flight as if it were an IFR flight? For an IFR flight, day or night, you need enough fuel to fly to your intended destination, from the intended destination to an alternate (if required), then to fly for another 45 minutes at normal cruising speed. Think of the safety margin if you plan your VFR flight with an alternate, even if it's one you never intend to land at. That would mean enough fuel to land at your destination, then fly to the alternate, with a 45-minute reserve above that! Think of the comfort factor as well with that extra fuel. Your alternate could be any airport along your route—an airport which you have confirmed has your type of fuel and will be open during your night flight.

Yes, fuel is expensive, but accidents cost more. Moreover, the FAA doesn't care if you exceed a standard. And if you're within your weight and balance considerations, there is no such thing as too much fuel, especially for a night VFR flight.

Experience in Type

How many takeoffs and landings have you had recently in the make and model aircraft you want to fly at night? How many days ago was that? Even among aircraft that are the same make and model, wear and tear on the control rigging can mean slightly different takeoff and landing characteristics. You may be accustomed to a particular make of communications equipment or even to using a headset and find yourself with an aircraft that has a different radio stack and no intercom.

Of course, not having a headset when you want it doesn't necessarily mean that is a show-stopper to your flight, unless that lack is so significant to you that it becomes a stressor. See, you, the pilot, could have arrived at the airport experienced, current, and in good physical condition, only to find something you weren't expecting with the airplane. It may not even be something that renders the aircraft unairworthy. The key is to assess and reassess how this will affect your VFR night flight. If flying with a headset makes you more comfortable, relaxed, and aware, then you might want to reconsider your night flight if you can't use one.

This may seem overly simplistic, but in this day and age when the slightest alteration in your driving speed can induce road rage, you can see how extrapolating something that may seem trivial to the aviation environment can create a situation in the pilot's mind that may block good judgement. And recall, too, we've talked about the accident chain. That lack of an intercom could be the first link in that chain, especially if you aggravate yourself about it the entire flight. Not being able to concentrate because you've wrapped yourself around a figurative axle over something minor is bad enough during the day. Add the pressure of night flight, and you may have pushed yourself beyond even the raised limits you've set for yourself.

Aircraft Performance

Do you really want to take off on a night VFR flight on a hot, humid night with your aircraft so close to its maximum gross weight that if you have a burger before you depart, you'll be overgross? Simplistic again, but as the old aviation adage goes, always leave yourself an out.

Have you distributed that load appropriately? Have you calculated the density altitude and determined you're within the performance of your aircraft? When was the last time you used the performance charts, anyway? Familiarizing yourself with "all available information" before a flight, as required by FAR § 91.103, is an important and necessary part of any flight, but expanding your personal definition of what is "all available information" beyond that listed in the FAR may be more necessary and important for a night VFR flight. Again, you're establishing a personal limit above that required by the FAA, and when you make a commitment to stay within that limit, you're self-assuring your safety.

Aircraft Equipment

Are you familiar with the avionics package on the aircraft you're about to fly at night? How much time do you have using an autopilot? How familiar are you not only with GPS but also with the GPS unit in this aircraft? Checking yourself out on new avionics or on a GPS you're not familiar with in the middle of a night VFR flight is not the right time nor the place. It may be as simple a decision as using the VOR or NDB instead of the GPS.

Is the NAV/COM appropriate for your flight? Are you familiar with its operation? Are there any "squawks" concerning it?

Do you have current charts? On a day flight with no weather problems you might "get away" with out of date charts, but why take the chance, not to mention that pesky FAR § 91.103 again? For a night flight, what if an unlighted powerline has been added along your route and it's not depicted on your out-of-date chart? Did you remember to check the *Airport/Facility Directory* for changes to the chart? Did you check NOTAM(L) and NOTAM(D)?

Have you checked NOTAMS for your route and destination? Are all the airport lights in operation, all the NAVAID's working that you'll need? Have you checked the *Airport/Facility Directory* to determine how you might turn on the pilot-operated lights if you're going to a non-towered airport? Wow, that "all available information" again. Obviously, the FAA put it there for a reason, and it's not to catch pilots in non-compliance but to help you set those limits for yourself. Now, that's not to say we look the other way if an accident or incident occurs because you did not obtain "all available information" as outlined in that regulation.

For example, if you're computer-

literate and use an on-line weather briefing service that does not provide NOTAMS or facility information, is that obtaining "all available information?" Depends. If that NOTAM contained information that you needed to assure a safe flight, maybe not. All the pretty radar pictures in the world won't help if you get to a non-towered airport and don't know how to turn on the pilot-operated lights or didn't know the airport was closed because a big construction crane is sitting at the end of the runway. Daytime cuts you some slack in that scenario; night time doesn't.

Under aircraft equipment, you also need to think about a couple of other things you may not associate with your aircraft. For example, what does one wear to the airport these days? We're not talking haute couture, but is what you're wearing conducive to perhaps a chilly (or sweltering) night-time preflight so that you won't be tempted to cut it short? Or are you dressed for a special occasion and don't want to get sweaty on a hot ramp while preflighting for a night flight? Dress in something that is both comfortable and not worrisome for your preflight, and for the flight as well. We're constantly going back to your physical condition. If your clothes are too tight, too hot, too binding, too scratchy while you're trying to fly, you won't have your full concentration on your night flight.

You have to balance your comfortable clothing against your survival considerations. This is the other "aircraft equipment" you may not give much thought to. What type of survival gear do you have on board? And are you dressed comfortably but for the terrain you might have to walk out of if you make an emergency night landing? Do you have a flash light in case the bulb burns out on your landing light or your cockpit lights fail? We can't go into a discussion of survival gear here (this is getting long enough after all), but there are plenty of information sources available to determine what you might need for a night VFR flight over the mountains, over sparsely populated country, or over water. Expand your limits and tap those resources.

The Environment

All right, you, the pilot, are set to go, and the aircraft is set to go. What's next? The flight environment.

Airport Conditions

What are the environmental conditions not only at your destination airport but at your departure airport? Is there a crosswind? Is the crosswind component within your aircraft's capability? When was the last time you practiced crosswind takeoffs and landings?

Have you calculated whether you have sufficient runway length for landing? One tendency of pilots landing at night is to stay high. If you land long, will there be sufficient runway for braking? For a night flight you might want to add a "fudge" factor to your takeoff and landing distances. If the POH says 500 feet for landing and rollout over a 50-foot obstacle, at night, you might want to increase that, again, as a personal limit that you're not willing to cross. Remember to use your altimeter to verify your altitude in the pattern and on final.

Weather

VFR weather minima are the same for day or night VFR flights in Class A through E airspace. In Class G airspace, the night VFR visibility requirements increase from one statute mile to three statute miles. Below 1,200 feet AGL, the cloud clearance requirement increases from clear of clouds in the daytime to 500 feet below, 1,000 feet above, and 2,000 feet horizontal at night.

Above 1,200 feet AGL but below 10,000 feet MSL, the night cloud clearance requirements are the same as day—500 below, 1,000 above, 2,000 horizontal. An exception to this is when you're remaining in the traffic pattern of an airport at night and within one-half mile from the runway: You can operate clear of clouds and with visibility less than three miles, but not less than one mile. For any flight away from any airport, you must obtain weather reports and forecasts. The old aviation adage, "If you want the weather to change, just wait a minute," is more truth than fiction. Departing with a weather report or forecast that is hours old is not good judgement, and having current and frequently updated weather reports during a night flight is essential.

The en route weather information services are abundant—as close as Flight Watch on your radio, but during preflight preparation, the key to safe planning for a VFR night flight is to observe trends. If you begin obtaining weather information during the day time, and you notice that visibility continues to lower throughout the day as haze increases, you can safely bet that with the diminishing light, the haze or other obstruction to visibility will still be there—you just can't see it. We can fly above haze or a marine layer of fog and have excellent visibility. The problem arises when you have to descend through it to land. You may still be perfectly legal and have your three miles at night, but you can abruptly go from having a visible horizon to not having one. Again, if you are night or instrument proficient, you can transition easily to using your instruments to supplement the diminished visual cues.

Again, if the rules say three miles but you're not night proficient or inexperienced at flying solely by reference to cockpit instruments in an emergency, five or seven or 10 miles might give you a safety margin. If the weather reports and forecasts don't support the personal limits you've established for yourself and your VFR night flight, the safest solution might be alternative transportation.

If, for whatever reason, you opt not to communicate verbally to update your weather information, you can always listen. Tune in Flight Watch, and you're bound to hear other pilots along your route requesting updates. You can also tune in ATIS at towered airports along your route. As you get closer to your destination, and you "hear" from several ATIS that visibility is diminishing at towered airports along your route, you can extrapolate that visibility is likely doing the same at your

destination, especially if it's being affected by the same weather system. Now's the time for that not-required-for-VFR alternate. Bypassing airports that you can safely get into to press on to your destination, only to find yourself in a black hole is another example of bad judgement. At the least, you land short of your destination and rent a car. At the worst, your executor gets to read your will at an impromptu family gathering.

The Pressures of External Influences

Trip Planning

When a friend and I used to plan vacations via general aviation, we always tacked a day on at either end. We didn't promise anyone that we'd show up for a specific time, and we didn't schedule work events until after that extra day. That way, there was no pressure on us to have to arrive someplace at the beginning or ending of the trip. If something happened at work, and we couldn't depart as planned, then we'd fly part way and plan to arrive the next day—or we didn't leave until the next day. In personal flying, this requires more flexibility than we sometimes allow ourselves. Particularly, if we're driven, Type A personalities at work, it is difficult to admit that we can't make everything happen on cue for a flight. Again, in the day time, you have a built-in margin of safety, but if your late departure for an event you simply must attend pushes you into a night flight that you're not prepared for (see all of the above), you could miss more than a family get-together. You could miss the rest of your life.

Diversion or Cancellation

To alleviate some of that external pressure, make certain everyone knows that you'll do your best to get there. Explain this as well to any passengers you're carrying, and make sure they do not make concrete plans for themselves that they try to hold you to. If they insist, remember you are the pilot in command, the sole authority for the safe conduct of the flight. Explain as well that, if necessary, you might have to land short of your destination and find alternative means to arrive. If you're going on vacation, this can mean lost money in terms of canceled hotel reservations and so forth, or could cost you more if you have to buy a last minute airline ticket, but all that can be recouped. Lost lives can't.

The external pressures of friends and family can be just as wrenching as bosses or charter passengers who don't understand a pilot's decision not to push into weather or a flight environment he or she is not prepared for. Again, you are the sole authority for the safe operation of that aircraft, and don't let anyone take that from you. If you have to assert yourself for safety considerations, and a friend decides never to fly with you again, you don't need that kind of friend. The more important the trip is to you or to a passenger who has influence over you, the more tendency there is to compromise the limits you've worked hard to set for yourself. In that case, it is just as important to make sure you have an alternative in mind. Always leave yourself an out, even if it's before you leave the ground.

Personal Equipment

To further ease some of that external pressure, always go prepared to stay longer than you expected. Bring contact lens solution along, extra medication, credit cards, and telephone numbers of people you might have to contact and tell you're going to be late. Pressing onward into deteriorating weather or into a night flight you're not prepared for because you don't have a phone number to call and say you're going to be late could be the final link in that accident chain.

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Personal Minimums Checklist

The concept of planning for the Pilot, the Aircraft, the enVironment, and External pressures—PAVE—may seem familiar to some of you who have participated in a seminar featured in the FAA's Aviation Safety Program for the past two years. Called "Personal Minimums Checklist," this program, through guided discussion, gets a pilot to think about each of those four factors and set personal limits for his or her flying. Each participant gets a checklist and is taken through a discussion of each item, then the pilot sets his or her personal minimums. We call it practicing conservatism without guilt, and we've given it quite a bit of emphasis. The program was developed with the assistance of industry trainers and psychologists who specialize in aviation human factors. Although not developed specifically for night VFR flying, you could develop two such sets of limits—one for day and one for night.

For further information or to see when a "Personal Minimums Checklist" presentation is scheduled for your area or to get a copy of the checklist, contact the operations Safety Program Manager at your local FAA Flight Standards District Office. The presentation is also on the web at <http://www.faa.gov/avr/news/asphome.htm>.

Night Operations

FAA's *Flight Training Handbook*, a training guide for instructors and students, has an entire section on night operations. There are many other commercial sources out there which provide good advice for night operations, but the *Flight Training Handbook* contains the official FAA "line." In its introduction to night operations, the Handbook echoes what we said in above:

> "Night operations differ from daylight operations only by the fact that vision is restricted at night. *As confidence is gained through experience* [emphasis added], many pilots prefer night operations over day operations because the air is usually smoother, and, generally, there is less air traffic to contend with."

That first sentence describing the difference between day and night operations is more complex than it

sounds. Not only does the absence of light mean a pilot sees less, but darkness also means your eyes respond differently.

(NOTE: AC 61-21A, *Flight Training Handbook* has been recently updated and reissued as the *Airplane Flying Handbook*, FAA-H-8083-3. It is available from the U.S. Government Printing Office. Call (202) 512-1800 for price information.)

Night Vision

Human beings are long past the time and place when we were nocturnal animals, if we ever were. If our visual anatomy now is basically unchanged from our paleo- and neolithic ancestors, we were really bad nighttime hunters. There are many animals in the world who see far better at night than we ever will, even with the human's use of night optical devices. However, the human eye can be trained or adapted to see better at night, and if we as pilots understand what the limits of our night vision are, we can compensate. To go along with that, if we keep ourselves healthy, we keep our eyesight healthy, and that includes our ability to adapt to diminished illumination. Good eyesight can be diminished by fatigue, a cold, vitamin deficiency, alcohol consumption, stimulants (i.e., caffeine), smoking (oxygen depletion), or even prescribed or over-the-counter medications.

We think of night vision as teamwork between the eyes and the mind, and that teamwork goes back to the consideration of your physical and mental condition of which we spoke. Your mind may be sharp, you may be mentally ready for a night flight, but if your eyes are not up to the task, you're not ready. Conversely, if your eyes are willing and able, but your mind is not into a night flight, again, your readiness is in question.

There is a physical reason for this. Our eyes are built to work differently at night. If we understand that difference, we can adapt and overcome the limits of our night vision. On the back of the eye--the retina--there are thousands of "rods" and "cones," which are light sensitive nerves. They form a layer upon which images are reflected. The rods and cones connect to the optic nerve which delivers the image to the brain for interpretation. That interpretation is nearly instantaneous. The cones are massed in the center of the retina, and the rods surround the cones.

Cones detect color, minute details, and faraway objects. The rods detect grays and provide peripheral vision. They also detect moving objects but not detail or color. In daylight, the rods and cones combine to give us color vision, peripheral vision, and the ability to see grays and moving objects. At night, the cones effectively shut down, and only the rods provide ambient, outside vision. This is a logical evolutionary adaptation: At night in the absence of light, colors are shades of gray anyway. However, if there is sufficient ambient light at night, like moonlight, the cones will function, though the colors will not be as distinctive as they are in full light.

Because the rods surround the cluster of cones in the center of the retina, in daylight you see an object best by looking directly at it. At night, in the absence of light, you'll best perceive an object in your peripheral vision because the rods are perceiving it, not the cones. As a pilot you can't rely on catching an object out of the corner of your eye. Rather, you have to practice off-center scanning of your instruments and of your visual cues outside the aircraft.

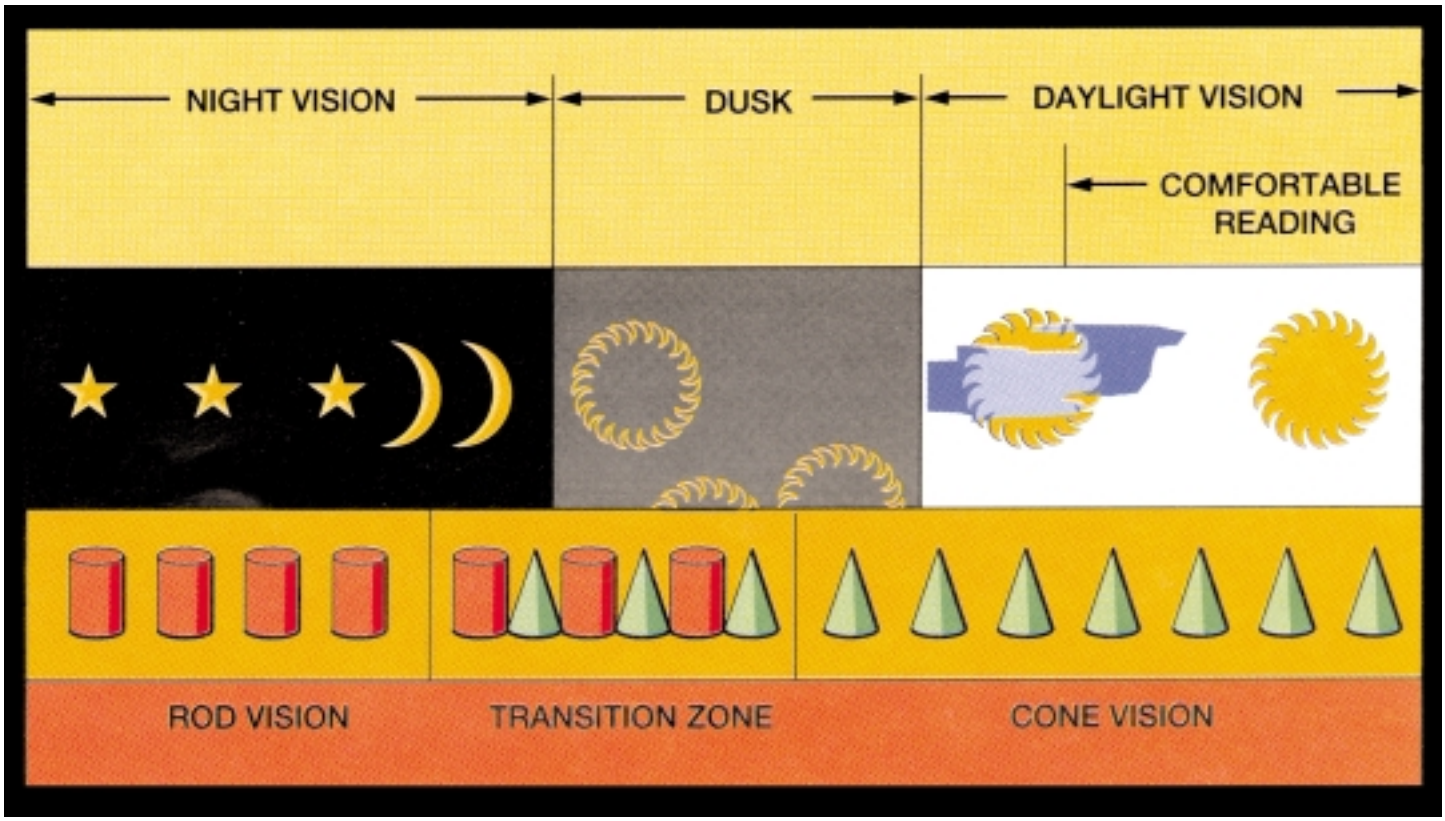
Our eyes can adapt to darkness. The pupils dilate to let in as much light as possible. To dilate to their maximum takes about five to 10 minutes, during which time, night vision improves progressively. After that initial five- to 10-minute adaptation, our eyes are 100 times more sensitive to light. After about 30 minutes, the rods become fully adjusted to the lack of light, and when they do adjust they are 100,000 times more sensitive to light than they were in the daylight. Once full adaptation is complete, you can see much more detail than in the early stages of adaptation where only the pupils dilate to let in what light is available. Night adaptation is completely disrupted by even brief exposure to a bright light, and that exposure can cause temporary blindness, after images, and illusions. Moreover, the adaptation process will have to start all over again.

Night vision adaptation needs to occur before flight, and, as indicated, this can take up to a half hour. To be able to see best at night, you need to build this adaptation time into your preflight planning. If you take off in the daylight or twilight, the adaptation occurs in flight, clearly not the best option, but a situation where you have little choice. Because you are aware your eyes are adapting from your knowledge of the process, you can even plan accordingly. For example, a landing is probably better attempted after full adaptation. So, if you've taken off in light or twilight, a half hour or so after full dark, you're adapted, and your eyes can better deal with a night landing.

Big caution here: After adaptation has occurred you have to be careful not to experience bright light, or the adaptation is undone.

Here is a night vision "checklist" that will help you make your night vision as good as possible:

- If possible, avoid bright sunlight before night flying, adapt the eyes to darkness before flight and keep them adapted.
- If you have oxygen on board, use it during a night flight. Since vision deterioration can occur at altitudes as low as 5,000 feet, oxygen will help your eyes function at their best. If you're a smoker, that threshold may be a great deal lower than 5,000 feet, and supplemental oxygen may not be able to achieve a significant improvement.
- When exposed to bright light, close one eye. It will remain night adapted.
- Take your sunglasses off after sunset, Joe Cool.
- Move your eyes more slowly at night.
- Blink your eyes more often if your vision becomes blurry.
- Concentrate to see objects.



- Force yourself to see "off center."
- Maintain yourself in good physical condition and avoid smoking, drinking, and using drugs which may be harmful to your vision.

Night Illusions

Seeing at night can induce some unique illusions that don't occur during day vision. The brain tries its best to interpret what the optic nerve is feeding it, and what the brain perceives may not necessarily match what you're seeing. If you're night vision adapted, for example, and are exposed to a bright light, you get an after image that can last for several minutes. This is like the flash of a camera going off in front of your face, and the resultant blind spot is annoying. In a cockpit at night, it can be dangerous.

The brain causes the illusions, meaning you can misjudge objects that would be easily recognized in daylight. The slant of a cloud could be mistaken for the horizon, or the lights of a city street could look exactly like runway lights. If the illusions are severe, disorientation can result. If you realize and accept that such illusions can occur, look twice at what you're viewing, and properly interpret your instruments, you can overcome the illusion.

There are other examples of night illusions. If the night is clear, distant, unmoving lights will look like stars or even other aircraft. If you perceive such a light above you and mistake it for an aircraft, you could be led into believing the horizon is below you. You reduce your altitude and strike terrain or an obstruction. The creation of a false horizon is one of the most serious night illusions. If the night is dark (no moonlight or starlight), the real horizon can be impossible to see. Some have called this the "black hole" effect, which can also affect both takeoff and landing. This is why being able to fly solely by reference to the cockpit instruments is an essential night flying skill. If one of these illusions appears to be a horizon, before you pitch to it, check the artificial horizon. Trust it more than the seat of your pants.

Oftentimes pilots at night focus too intently on a single source of light. Once that occurs, the light appears to move. The phenomenon is called "visual autokinesis," and the trouble occurs when you perceive the moving light as another aircraft, perhaps on a collision course. As you turn to avoid a collision with the phantom aircraft, you contact terrain or become disoriented. Visual autokinesis can occur after fixating on a light for only a few seconds. To prevent this, rather than focusing on the single source of light, expand your visual field, force yourself to take in more of your surroundings, and the light remains stationary.

Regulations require a certain number of outside aircraft lights to be on at night for safety. But a strobe light can be very distracting, especially when you're maintaining legal distances from clouds and you get "echoes" or reflections off the clouds. Internal cockpit lights can flicker for a variety of reasons and distract you from perceiving your visual cues properly. The worst case scenario is that a strobe or intermittent light in the cockpit can cause flicker vertigo, which can incapacitate you through nausea, dizziness, grogginess, headaches, or confusion. Severe flicker vertigo can render a susceptible pilot impaired or incapacitated.

Earlier we mentioned making an approach to landing at night with night-adapted eyes, and we also referenced the "black hole" effect where you lose your horizon. Another "black hole" danger can occur when you make an approach to land from over water or from over terrain which is unlighted. The runway lights are the only source of light, and remember if you focus on them too much, visual autokinesis can occur. The lights could

appear to float or move if you use them for your only visual cues. When we're first learning to land, we're taught that many of our visual cues for landing come from our peripheral vision and that it is important to move our aiming point on the runway continuously ahead of the aircraft--a bit of problem at night. At night, because of the brightness or dimness of the runway lights, the runway could appear to be closer or further away, upslope or downslope. This, where electronic navigation and being able to use your cockpit instruments as a substitute for your "missing" peripheral vision, is essential. Lighted or fluorescent-painted VASI's or PAPI's, flying the glide slope, interpreting the configuration of runway lighting, and using flight instruments to maintain proper orientation and height above the ground can help you make a normal night approach and overcome the black hole effect.

A couple of caution notes:

- Approach lighting can be a good visual cue at night, but you have to be familiar with the configuration. Pilots have mistaken the double row of approach lights for runway edge lights. Because the rows of approach lights are closer together than runway edge lights, pilots have landed short of the runway at night, in the midst of the approach light stanchions. The visual illusion was that they were too high, so they did not heed the cockpit instruments and reduced altitude, resulting in a fairly classic controlled flight into terrain accident.
- When turning on pilot-operated runway lights, listen to UNICOM for traffic and other pilots activating the system. Judge very carefully when you turn them on. Most of these systems are on a timer, which turn them off after an amount of time deemed reasonable for an approach and landing. If you turn them on too soon, they could cut off in the middle of your landing. Trying to key the activation sequence again is a major distraction at that point. Turn them on too late, and the sudden flare of light can be a distraction as well. As part of your preflight planning, a call to your destination airport to determine how long the pilot-operated lights stay on will give you the information to know just exactly when during your approach you should turn the lights on.

After all this discussion of illusions and distractions, night flight might seem as frightening as the monsters under our beds at night when we were children. As we grew, though, we realized there were no monsters under the bed (the closet could be a different matter), and so it is with night flying. As our experience as pilots grows, that confidence develops, and a night flight can be not only successful, but rewarding.

Pilot Equipment

FAR § 91.205, Instrument and Equipment Requirements, lists the required aircraft equipment for day or night, VFR or IFR flights, but pilots should consider one extra piece of personal equipment that is fairly inexpensive and can be one of the most important pieces of safety equipment in the cockpit at night-provided the batteries are fresh. We're speaking of a flashlight, preferably one where you can switch from white light to red. The white beam can be used for night preflights and shouldn't disrupt your eyes' night adaptation if you don't shine it directly in your face. The red beam can be used inside the cockpit for reading checklists and so forth since it won't destroy your night adapted vision. However, since some information on aeronautical charts or checklists is printed in red or a variation thereof, like magenta, the red may not be visible or may be difficult to read. Again, as long as you're aware of this possibility, you can adjust, switching between the two beams as necessary to see all the information clearly.

There are many commercial flashlights out there, from ones which clip in a shirt pocket or onto a blouse and with a flexible neck to put the light exactly where needed to those on a lanyard that can be worn around the neck. The ideal size is probably as small as possible with as much light as possible for the size. Select what works best for you and make it a part of your flight bag.

Needless to say, a spare set of batteries and a spare bulb in that same flight bag is essential--and make sure they're the right size for the flashlight.

Another aside here about night preflights. Preflight at night may take longer to accomplish, but it is important not to forego this inspection because there is a lack of light. If you don't have a flashlight--remember, it's not required except on certain air carrier flights--try to do the preflight in a lighted area. Of course, if you do that, you'll have to wait for your eyes to adapt, or re-adapt as the case may be. This is why night flights require attention to planning and preparation and involve details that day flights don't entail.

The appropriate and current aeronautical charts and other information about airports are another important piece of personal equipment for a night flight. Cities and towns which are prominent landmarks during the day, may also be visible at night because of street and residential lighting, but they may not be so easily identifiable. Only current charts can help you with that identification. Here on the east coast, for example, from Boston to North Carolina there is nearly a constant run of city lights which merge into each other. However, with current charts and by checking landmarks carefully and confirming them with electronic navigation, you can safely navigate VFR at night.

One of the night illusions associated with city or town lights is just how far distant lights can be seen at night, particularly in wide open spaces where the towns are spaced apart. The lights which may seem close may actually be miles distant and not the town you've planned to fly to. That is why electronic navigation as a supplement is so important to a successful VFR night flight.

Airplane Equipment and Lighting

In the previous subject we men-

tioned FAR § 91.205 and the requirements for night flight, and we listed them fairly extensively, but here is a good point to review aircraft position lights and recall how we were taught to interpret another aircraft's position relative to our own when viewing the trio of lights at night. There is a red position light on the left wing, a green one on the right wing, and a white one on the tail.

A word about landing lights at night: Like any needed item, landing lights have been known to fail almost exclusively at night. To build up your confidence so that you know how to deal with that minor emergency, consider taking some time with a flight instructor at night and practicing night landings without the landing light. For safety, pick an instructor who's experienced at night flight and an airport you're familiar with for this practice. That familiarity takes some of the edge off and helps you build a skill that you can call on when you're someplace not so familiar.

Airport and Navigation Lighting Aids

Again, let's review how we can recognize that we have indeed reached an airport at night and not the parking lot of a shopping mall. Airport locations are indicated at night by a rotating beacon. The beacon rotates at a constant speed with a series of light flashes in different colors to aid in identification. As an old middle school teacher, I just can't resist those pop quizzes. In this one, match the description of the rotating beacon with the type of airport. The answer is at the end of the article. Come on, this is an easy one.

__Alternating white and green
__Two quick white then green
__Alternating white and yellow

a. military airport
b. civilian water airport
c. civilian land airport

White, green, and yellow are used on airports to identify them and red lights, either steady or flashing, denote obstructions off airport that may be a hazard to navigation. High intensity white lights mark supporting structures of powerlines or other tall structures such as smokestacks or towers.

Runway lights themselves are white, and taxiway lights are blue. Yellow lights outline a caution zone on a runway, and sometimes the pilot can adjust the intensity of runway lights, as well as turn them on and off. A large, busy airport at night can be a virtual sea of lights, and understanding the configuration of runway and taxiway lights is essential for safe taxiing. All the various, possible configuration of approach, runway, and taxiway lights are shown in the *Aeronautical Information Manual*, which is now on-line at <http://www.faa.gov/ATPubs/AIM/AIMTOC.HTM>.

All right, after all these cautions and philosophizing, time to get down to it. Let's examine a hypothetical night VFR flight from beginning to end, and within that fiction is knowledge so logical, you may have overlooked it. What follows may seem simplistic to a seasoned pilot, but everybody can stand a review once in a while.

Preparation and Preflight

Preflight planning and preparation have been themes running through this article, and they just can't be emphasized enough, not just for night flights, either. Statistics show that between 1995 through 1997, there were 46 night time VFR accidents which had a probable cause concerning the preflight.

Another good quote from the FAA's *Flight Training Handbook* goes like this:

> "Night flying requires that pilots be aware of, and operate within, their abilities and limitations. Although careful planning of any flight is essential, night flying demands more attention to the details of preflight planning and preparation."

There's the simple logic I mentioned.

FAR § 91.103, Preflight Action, has that catch-all phrase, "all available information." Let's try to define what that might mean for a night VFR flight:

- A thorough review of available weather reports and forecasts, with a good eye to the temperature/dew point spread. Any restriction to visibility complicates a night VFR flight, and a narrow temperature/dew point spread means the possibility of fog. Fog that you can't see because it's dark, that you won't see until you're in it.
- A consideration of wind direction and speed. During the day, you can tell when wind is stronger than forecast by its pattern on crops or water, by the fact that your landmarks come up slower than expected. All of these cues are more difficult to pick up on at night.
- Appropriate aeronautical charts, including the appropriate adjacent charts. Draw your course-line in a heavier weight, and note --maybe circle--prominent lighted checkpoints. Mark as well any obstructions to look out for, but they make excellent visual cues for navigation. Major roads can still be distinguished at night, and electronic NAVAID's along your course should be noted as well.
- Check that you have everything you need in your flight bag before flight--extra batteries or better yet an extra flashlight.
- Check your aircraft position and anti-collision lights for operation during the preflight, the landing light as well. Check for loose connection by tapping the light to see if it flickers.
- Last, but not least, do a walkaround of the immediate area of the ramp or taxiway. Large FOD is easy to spot in the daytime, but not so easy at night.

Starting, Taxiing, and Runup

Preflight planning and preparation are thorough and complete. Time to get this trip underway. Before starting the engine, arrange the items--charts, flashlight, headset, pens, pencils--you will need. Some duties, such as hold-

ing onto flashlights and charts can be delegated to a passenger, but when solo, get everything in order yourself. You might also want to fold or unfold your charts, as the case may be, to your course and arrange them in the sequence you'll need them.

So as not to tax your electrical system before a night flight, don't turn on all your electrical equipment before starting the engine, just what you need for safety: position lights or rotating beacon or strobes, for example, to alert others to aircraft movement. A final pass of your flashlight outside the aircraft and around the propeller area might be a good idea as well before starting the engine. Just because it's dark and quiet, perhaps, doesn't mean you shouldn't call "Clear prop!" at night.

If you have taxi lights or you want to taxi with the landing lights on, turn them on only after you've started the engine. Concerning the landing light--it helps your visibility tremendously but in some aircraft if you operate it continuously at the low RPM's associated with taxiing, the drain on the electrical system can be severe. Slow taxiing speeds can also mean the landing light can overheat and fail. The *Flight Training Handbook* says to use them "as necessary" during taxi, but be mindful that other pilots may be night adapting their eyes and don't need your landing light to suddenly come on. Taxiing itself might need to be slower than what you would do during the day to give you time to see taxiway lines or lights.

That peripheral vision we have during the day also cues us when we're letting the airplane creep during runup. This is not so easily detected at night, so alertness for this is another item on the runup checklist. Hold the brakes as heavily as you can to prevent forward movement.

Takeoff and Climb

Taxi and runup are on the numbers, and now you're faced with the possibility of making a takeoff into a dark night. Night time VFR accidents between 1995 and 1997 show that you are more than five times as likely to have an accident during the takeoff and climb phase of flight (73 accidents) than you are during the standing and taxiing phase of flight (14 accidents). The use of your cockpit instruments helps you not only en route and on landing but on takeoff as well. Adjust your cockpit lighting so that the brightness doesn't overcome your night-adapted eyes but not so dim that you can't read the instruments. Just the right level of cockpit lighting will let you read and interpret the instruments but will not reflect on windows enough to distract you.

Taxi and landing light on, line up on the centerline, and use the runway edge lights as a visual cue. Check the heading indicator to make sure it reflects the runway heading. You can use that to track the centerline if need be. All the takeoff procedures are the same as for daytime, but you'll need to check the flight instruments more frequently to maintain proper attitude, heading, and airspeed. At the appropriate airspeed, adjust pitch for a normal climb and verify using both cockpit instruments and any outside visual cues, such as runway lights.

Because you can't see the ground move away from you as you can during the day, maintaining a positive rate of climb can be done with the attitude indicator and/or the vertical speed indicator, as well as the altimeter--three instrument sources of information to replace the visual source. At night as in daytime, best rate of climb airspeed should be used, except where best angle is required. Because turns can induce vertigo so quickly at night, wait until reaching a safe maneuvering altitude before beginning turns and use your instruments to verify that the turns are coordinated. If you've taken off with your landing light on, once you've left the runway, it's of little use. To save strain on the electrical system, turn it off.

Orientation and Navigation

Aside from the daunting prospect of taking off into the dark, night takeoffs vary little from daytime ones. The same is true of navigation en route. VFR at night can be done on instruments (however, the pilot is still responsible for see and avoid) or can be a combination of pilotage and dead reckoning as during the day, but electronic NAVAID's are the best way to keep yourself oriented at night, especially over areas where the night visual cues, such as prominent lighted objects, may be scarce.

Probably the most significant problem that can occur to a pilot navigating at night is flying into weather that you are unable to see. When there are lighted landmarks to see, you can look out for low clouds or fog by noticing when lighted objects on the ground become dim or obscured. The lights themselves will have a halo or glow around them, and when you spot that, continuing in that direction is not a safe alternative. When you're at altitude, above the obscuration, it may not appear to be as problematic as when you begin your approach and inadvertently enter a situation where you lose visibility. If that happens, again, the instruments can keep you straight and level and assist you in making a 180 out of the area. Remember, also that you have less visibility in fog and clouds looking forward than you do looking out the side window and straight down.

Again, the *Flight Training Handbook* states it simply but eloquently:

> "Under no circumstances should a VFR night-flight be made during poor or marginal weather conditions..."

One of our veteran aviation safety program managers, Mr. Scott Gardiner in Seattle, Washington, adds this:

"There have been two occasions in my own personal flying career when I entered clouds while operating VFR at night. Both times I had done a thorough preflight, including extensive weather briefings. Both times, I was convinced that there would be no clouds along my route of flight at my altitude. For example, on one occasion, I would be flying at

7,500 feet MSL, and the only reported or forecast clouds were above 20,000 feet MSL. And yet, I entered clouds and never even saw them coming. They were not serious clouds associated with a frontal condition or thunderstorms. These were rather benign clouds, still they were big enough to require two to five minutes to maneuver out of them. The reason I did not see the clouds coming is--it was night time. Very dark, moonless nights over uninhabited terrain."

How to overcome this potential threat if night time prevents us from seeing clouds?

Training. Practice. Training. Experience. Training. Detecting a pattern?

For VFR at night, being competent at straight and level flight and being able to make coordinated turns may not be enough. You need to be competent at those maneuvers as well as climbs, descents, climbing and descending turns, steep turns, and recovery from unusual attitudes--*all by reference to instruments*. Again, you may be absolutely proficient at these maneuvers, even unusual attitudes, in the daytime, but you perform these maneuvers usually by referencing outside visual cues, supplemented by the cockpit instruments. At night, your recovery depends on your ability to interpret the instruments properly and trust what they are showing over the physical sensations you're experiencing. We've done plenty of articles on the physical causes of spatial disorientation, so we're not going into the anatomy of the inner ear here, but to be a proficient night VFR pilot you must be able to understand that your perceptions of reality and the reality presented by your instruments may be in conflict. The reality presented by your instruments is what you have to follow to operate safely. The only way you can be successful at this is to be trained properly and to practice until it becomes instinctual. Even then, you have to maintain proficiency at flight solely by reference to instruments, or the instinct fades.

If your night VFR flight takes you across a large body of water, and particularly if you're in a single-engine aircraft, you have to be even more cautious, your planning even more thorough. Ditching in the water at night is actually the least of your concerns, given lack of depth perception, the black hole effect, lack of orientation, maritime weather conditions, and so on. Even when the night is clear, and the stars bright, they can reflect on the water and turn up into down unless careful attention is paid to the instruments.

Given all that, you've successfully completed the en route portion of your VFR night flight and are now in range of your destination airport. This seems to be the most hazardous phase of flight. Between 1995 and 1997 there were 223 night time VFR accidents during approach and landing.

Approaches and Landing

Sometimes we overlook the obvious because it is there in front of us. For example, the FAA's *Flight Training Handbook* again offers some simple wisdom:

> "Every effort should be made to maintain the recommended airspeeds and execute the approach and landing in the same manner as during the day."

Airspeed is airspeed day or night, but possibly the biggest hindrance to accomplishing a night approach the same as during the day is a lack of depth perception and the accompanying inability to judge distance. Yet again, the cockpit instruments, particularly the altimeter, is a partial substitute for your depth perception. Of course, that gives you vertical distance and not forward, and we've already discussed the illusions that approach lighting can create when fixating on them to try and judge distance. The key is to fly an exact traffic pattern, one of proper size and direction for the airport in question, and your instruments will help you do that.

On final, align yourself midway between the rows of runway lights. Some airports have lighted centerlines, and this is something you should have determined during preflight so that you don't line yourself up between the centerline lights and one set of runway edge lights by mistake. A stabilized approach works at night just as in the day, as do the use of flaps. During a night approach, the landing light is turned on about halfway down final. Any higher than that, and it's nearly useless in lighting any object for you. In fact, it may reflect off terrain, like water, and back into your eyes, undoing your night-adapted eyes just when you need them the most.

An inexperienced night pilot tends to flare too high, possibly because of a fear of contacting terrain he or she can't see. To overcome this, maintain a stabilized approach until the landing light shows the runway. At that point a good identifying cue for the flare are the tire marks on either side of the centerline. Landing technique from flare on to touchdown is the same as for the daytime.

If for some reason you have no landing light or you and your instructor are practicing landings without the landing light, sighting the runway end lights at the far end of the runway is the cue for the flare. When they appear to rise higher than the aircraft's nose, time to roundout. You may have to "feel" for the runway with a bit of power and pitch, but the point is to use what visual cues you have to complete the landing successfully. Remember not to fixate on any lights used as visual cues for a night landing because of the visual autokinesis phenomenon.

Safely landed at last! There is one more consideration we need to talk about, and that is emergencies. Daytime emergencies are stressful enough and can be dealt with through training and proficiency. A night time emergency is something no pilot wants to experience, in theory or reality.

Night Emergencies

The thought of an engine-out emergency at night and having to make an off-airport landing as a result can bring sweat to the palms of even the most seasoned aviator. However, accident statistics show that failing to deal with an engine-out emergency at night is

not among the top accident causes. (Continuing flight into adverse weather and poor pilot judgement are the top causes.) The old flight instructor adage, "Remember to fly the airplane," applies equally for day or night emergencies, and as during the day, you will find that being busy dealing with the emergency will take your mind off the fact that it is at night. This confidence and ability comes only with...? You got it. Practice.

Here are some things that the FAA recommends you keep in mind in an engine-out emergency at night:

- Fly the airplane, as we've already said, or as the *Flight Training Handbook* puts it, "Maintain positive control...and establish the best glide configuration and airspeed."
- The temptation at night is to "go toward the light," but that usually means a congested area with lots of obstacles and persons and property on the ground. The ideal locale for an emergency landing is always an airport, day or night. Your charts are an essential tool in locating a nearby airport. If you know the terrain or can make a good determination from your charts, head for an unlighted area and plan your emergency landing for there. If you're close to some type of public access--a road, a railroad track, and so on--try to land as close to that as possible for ease of help getting to you or your going for help.
- Follow your emergency checklist and the manufacturer's recommended procedures to try and diagnose the problem and attempt an engine restart.
- Communicate your situation on UNICOM or to air traffic control. 121.5 is always available.
- As in the daytime, land into the wind, and complete the before landing checklist. Check your landing light to see if it is still operative and turn it on to show the terrain or obstacles. Again, just as with an emergency landing during the daytime, at night land as normally as possible and at the slowest possible airspeed. If you have no landing light and no visual references, maintain a level landing attitude and fly to ground contact. After the landing, the procedures to secure the aircraft are the same as for day flights--turn off all switches and get out of the airplane as quickly as possible.

We haven't said much about flight plans for night flights. After all, a flight plan in and of itself does not prevent an accident; it merely gets the search and rescue started sooner when you don't show up. When you've just made an emergency landing at night, perhaps in the middle of nowhere, a filed flight plan can give a feeling of comfort and optimism.

This also brings to mind the importance of a functioning ELT. Even if your emergency landing technique is good enough not to set the ELT off on contact, you need to switch it to "ON" to aid rescuers. And what better time to mention the benefits of being accurately and swiftly pinpointed by a 406 MHz ELT?

Conclusion

We've shown that a VFR night flight can be completed with thorough planning and preparation and by a well-trained and proficient pilot. Give some thought on how to become that pilot, well-trained and proficient enough to deal with a VFR night flight. In recent years, the FAA has made it incredibly easy to obtain an instrument rating. No longer do you have to accumulate a certain number of hours, for as soon as you earn your private pilot certificate you can begin your instrument instruction.

So, why not? Likely if you can afford the average 70+ hours of instruction to receive your private pilot's certificate, the additional hours of instrument training are just as affordable and well worth the effort. Experienced pilots within and outside the FAA have called the instrument rating "the cheapest insurance you can buy." Accident statistics tend to confirm that: accident rates among instrument rated pilots between 400 and 1,000 hours are considerably less than those for non-instrument rated pilots at the same experience level. After my instrument rating I really felt as if I had a better feel for an airplane and definitely more confidence in being able to handle marginal weather situations.

In this article I've beaten to death the concept that VFR night flight can be successful every time if the pilot is thoroughly prepared and trained for night operations. You can be proficient at flight solely by reference to instruments without obtaining an instrument rating, but an instrument rating, judiciously used, can also open another aspect of aviation to you. Getting an instrument rating was also some of the most fun flying I had experienced (seaplane rating has to be tops), and with the ease of obtaining an instrument rating now, there may be no good excuse not to get it. There are many highly experienced, very competent, non-instrument rated pilots out there who will likely disagree, and they can make their case as well as I've tried to make mine. I believe that aviation is an opportunity to grow and learn continuously, and the truly good pilot learns something from every flight. Obtaining the instrument "ticket" is an important step in your continuing aviation education.

We climb mountains because they're there. We participate in extreme sports for the incredible rush. Earning an instrument rating that could save your life or your passengers' lives is more reasonable in some ways than "because it's there" or "because it's a rush." However, earning an instrument rating because it's available or because it's fun is as good as excuse as any.

Instrument rated or extremely proficient at instrument flight, the night sky awaits, and, if you've done everything you need to do, it can be a flight experience both challenging and sublime.

Quiz answers: c, a, b

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